Appendix H

Aircraft Survivability Equipment

SECTION I—FUNDAMENTALS AND THREAT CONSIDERATIONS

FUNDAMENTALS OF AIRCRAFT SURVIVABILITY

H-1. Tactical helicopters are protected with ASE while operating throughout the battlefield conducting their assigned missions. Aircraft survivability encompasses a vast array of disciplines. There is a tendency to equate ASE as the whole of aircraft survivability. ASE is a portion of EW, which is but one pillar that supports IO and/or IW. FM 100-6 changed EW terminology to the following three functions:

ELECTRONIC ATTACK

H-2. Electronic attack [formerly ECM] is that division of EW involving the use of electromagnetic or directed energy to attack personnel, facilities, and equipment with the intent of degrading, neutralizing, or destroying enemy combat capability. Electronic attack includes actions taken to prevent or reduce the enemy's effective use of the electromagnetic spectrum through jamming, destruction, and electromagnetic deception. Electronic attack includes the employment of weapons using either electromagnetic or directed energy (such as lasers, radio frequency, and particle beams) as their primary destructive mechanism. Electronic attack also includes the employment of weapons using sources of electromagnetic energy as the primary means of terminal weapons guidance for the purpose of damaging or destroying personnel, facilities, or equipment. ASE systems include chaff, flares, radar jamming, and IR jamming.

ELECTRONIC PROTECTION

H-3. EP (formerly ECCM) is that part of EW involving actions taken to protect personnel, facilities, and equipment from effects of friendly or enemy EW actions that may degrade, neutralize, or destroy friendly combat capability. To minimize their vulnerability to electronic attack, EP should be considered for all battlefield systems deriving operational capabilities through the use of the electromagnetic spectrum. Included are optical, electronic, IR, and radar target acquisition, NCTR systems, as well as smart weapons systems' sensors, fuses, guidance, and control components. ASE systems include antenna design, signature reduction, and IR absorbing paint.

ELECTRONIC SUPPORT

H-4. ES (formerly ESM) is the division of EW involving actions tasked by, or under the direct control of, an operational commander. The purpose of this division is to search for, intercept, identify, and locate sources of radiated electromagnetic energy for immediate threat recognition in support of EW

operations and other tactical actions such as threat avoidance, homing, and targeting. ES focuses on surveillance of the electromagnetic spectrum in support of the commander's immediate decision making requirements for the employment of EW or other tactical actions, such as threat avoidance, targeting, or homing. ES is normally provided by organic intelligence and sensing devices based on EW technology integrated into other weapon systems, or assets from other echelons capable of providing combat information to the supported command. The purpose of ES is to ensure electronic attack and EP applications receive the input needed to operate effectively. Examples of ES actions are battlefield systems that execute direction finding operations, detect and identify enemy missions or other electromagnetically-measured signatures for immediate exploitation, locate high value targets for electronic attack, and provide threat avoidance information. ASE systems include radar, laser, and IR missile detecting sets.

AIRCRAFT SURVIVABILITY EQUIPMENT TENETS

H-5. The role of ASE is to reduce the vulnerability of our aircraft, thus allowing the aircrew to accomplish their immediate mission and to survive to fight another day. The methodology to achieving survivability is supported by the ASE tenets—a five-fold approach to ensure that Army aircrews are able to accomplish their mission again and again. Sound tactical flight and signature reduction provides the baseline. Warning leads to jamming, and each tenet is sequential starting from the most effective and least expensive to the least effective and most expensive. These five tenets are listed below in the order of least cost and most effective to the greatest cost and least effective.

TACTICS (ELECTRONIC PROTECTION)

H-6. Proper tactics reduce exposure times to enemy weapons. NOE flight not only limits LOS exposure times, but also places the aircraft's radar, IR, and optical signature in a cluttered environment. NOE tactics combined with ASE protection and standoff ranges allow Army aviation to not only survive, but perform its mission on the battlefield. ASE protection is severely degraded when the aircraft is not flown tactically sound (blue-sky background).

SIGNATURE REDUCTION (ELECTRONIC PROTECTION)

H-7. These measures are taken into account by engineering or design changes such as flat canopies, exhaust suppressers, and coating the aircraft with low-IR reflective paint. Signature reduction alone greatly increases survivability. Without signature reduction, ASE effectiveness is degraded and, in some cases, erased. Signature control is also performed by the aviator choosing how much signature to expose to the threat.

WARNING (ELECTRONIC SUPPORT)

H-8. The next step in ASE protection is to provide warning to aircrews when they are about to be engaged, allowing them time to react. Examples of such warning devices are radar, laser detecting sets, and IR missile warning systems.

JAMMING AND DECOYING (ELECTRONIC ATTACK)

H-9. When aircrews must stay on station despite warnings, countermeasures capable of jamming and or decoying the fire control or guidance systems of threat weapons are required. Chaff, flares, and radar and IR jammers provide this type protection.

AIRCRAFT HARDENING (VULNERABILITY REDUCTION)

H-10. Aircraft hardening provides for ballistic tolerance, redundant critical flight systems, and crashworthy features in an attempt to minimize the damage to an aircraft once it has been hit.

THREAT CONSIDERATIONS

H-11. This section is not designed to be system specific in nature, but rather to provide a general knowledge of threat systems that can be applied to specific threats on a case by case basis.

THREAT ENGAGEMENT SEQUENCE

H-12. All weapon systems must complete a series of events, called an engagement sequence, to actually have effect on the target (aircraft). Any step in the engagement sequence that is missed forces the threat to start over again. Weapon systems sensors must—

- Detect.
- Acquire.
- Track.
- Launch and guide (or fire and ballistics).
- Assess damage.

EXAMPLE THREAT SYSTEM

H-13. Five elements required to compute an AAA fire control solution are range, azimuth, elevation, velocity, and TOF. If one of the fire elements is incorrect, the AAA system will not hit the target.

TIME AND SPACE

H-14. The threat must detect, acquire, track (establish fire control solution), and fire at the aircraft. The time of flight of the projectile must be determined. The threat must predict where the aircraft target will be (within a few meters) when its ordinance travels to a point in space and time.

TOOLS

H-15. Tactics, signature reduction, warning, jamming, and decoys are the tools available to preclude a successful threat engagement. If hit you may have to count on aircraft hardening.

ACQUISITION VERSUS TRACK

H-16. The difference between detection and acquisition versus tracking is very important. In detection and acquisition, the threat weapon system does

not have refined data to fire at you. The threat weapon system must track the aircraft long enough to determine range, azimuth, elevation, and velocity to predict when and where to fire to hit its target. Indications of search or acquisition activity may indicate to the aircrew time to increase their vigilance (e.g., change mode of flight, actively searching for masking terrain features). Tracking indications alert the aircrew to an immediate action requirement (masking or when terrain is not readily available, ASE decoys and evasive maneuvers).

ENGAGEMENT ENVELOPE

H-17. All threat systems are confined by physics. Each system has a maximum altitude and range in which its projectile will travel. Additionally, all threat systems have a minimum and maximum effective altitude and range. These numbers are computed against a cooperative engagement (nonmaneuvering aircraft, blue sky background, flat terrain, and steady velocity, if any). The effective envelope for a threat system is based upon a 50 percentile. That is, at the maximum (or minimum) effective range (or altitude), the weapon system is able to hit the target one out of two times. As the target gets further into the threat's envelope, the probability of a first shot kill increases. As the target gets further outside the threat envelope, the probability decreases until the target is outside the threats maximum range (or altitude) where it is physically impossible to be hit.

DECREASING THE PROBABILITY OF HIT

H-18. The aircrew has the ability to make the engagement more difficult for the threat. A stationary target for example allows the threat to adjust each shot off the last until it hits the aircraft. A more difficult engagement would be a moving, constant velocity shot. A prediction can be made and if a miss occurs, an adjustment can be made based off the last shot. The most difficult engagement is against a moving target that varies range, altitude, elevation, and velocity. This type of engagement makes prediction impossible because four factors are changing at differing rates.

THREAT WEAPON SENSORS

H-19. There are generally four major types of threat weapon sensors—radar, IR, laser and DEW, and optical and/or EO. These may be man portable or transported by land, sea, or aerial platforms. It is important to determine the actual sensor type and guidance package for each threat and understand their inherent capabilities and limitations. (For in depth information concerning particular threat systems, contact your unit ASE, EWO, or tactical operations officer.)

RADAR

H-20. Direct threat radar weapons require LOS to hit the target. Direct threat radar weapons are either fire controlled AAA or for missile systems command, SARH, active radar homing, TVM, or GAS. Radar weapons must detect, acquire, track, launch and guide (or fire a ballistic solution), and assess damage. Radar systems have trouble with ground clutter. To pick out targets from ground clutter, radar systems can detect movement though the

use of MTI, Doppler (continuous wave radar), or pulse Doppler. Modern radar systems can and do track not only the movement of the aircraft itself, but some detect the movement of rotor blades. A few older radar systems had blind speeds (called a Doppler notch) where they could not detect an aircraft flying a specific speed towards or away from the radar. However, not only do modern radar systems cancel blind speeds, but even with older radar systems, an aircraft had difficulty maintaining constant speed and angle to or from the one radar. It also is impossible to be in the Doppler notch of more than one radar. Radar systems can be detected, avoided, decoyed, jammed, and destroyed by direct and indirect fires (self, artillery, and antiradiation missiles).

INFRARED

H-21. All IR direct threat weapons require LOS to be established prior to launch, and the in-flight missile must maintain LOS with the target until impact (or detonation of the proximity fuse). IR missiles require the operator to visually detect the target and energize the seeker before the sensor acquires the target. The operator must track the target with the seeker caged to the LOS until it is determined the seeker is tracking the target and not any background objects (such as natural or man-made objects to include vehicles, the sun, or reflected energy of the sun off clouds). The IR sensor is also susceptible to atmospheric conditions (haze, humidity), the signature of the aircraft and its background, flares, decoys, and jamming. Generally IR systems are—

- Difficult to detect prior to launch (passive sensor).
- Difficult to predict where they may be located (portability).
- Difficult to respond to (short TOF after launched).
- Difficult to hard kill (requires shooting at an in-flight missile).

LASER AND/OR DIRECTED ENERGY WEAPONS

H-22. Laser and/or DEW weapons really fit two distinct categories—laser guided or aided weapons and pure laser and/or DEW weapons. Laser guided or aided weapons are those who use the laser to perform ranging, tracking, or guiding functions for conventional explosive missiles or projectiles. Pure laser and/or DEW weapons use laser and other forms of DEW to inflict damage to the aircraft or its sensors (as a by-product, the aircrews eyes may be damaged). Pure laser and/or DEW weapons are not required to burn a hole in the target to destroy it, although these weapons are reaching that capability. Simply igniting fuel vapor near vents or burning through fuel lines are effective as well as glazing the cockpit glass so the aircrew cannot see out is also effective. Inherently, laser and/or DEW weapons are short duration, hard to detect, extremely hard to decoy or jam, and hard to kill. Fortunately they must rely upon LOS, atmospheric conditions, and are somewhat short ranged at present.

OPTICAL AND/OR ELECTRO-OPTICAL

H-23. Optical and/or EO sensors are used as either the primary or the secondary sensor for all weapon systems. Although they rely upon LOS, they are with very few exceptions, completely passive. They are limited by human

eyes, atmospheric conditions, distance, jitter, and in many cases by darkness. The optical and/or EO sensors are most difficult to detect, seldom can be decoyed, can be jammed in the sense of obscurants, but when located can be hard killed.

SECTION II—AIRCRAFT SURVIVABILITY EQUIPMENT SYSTEMS

CATEGORIES

H-24. ASE systems can be categorized in three areas—aircraft signature reduction, situational awareness, and active countermeasures.

AIRCRAFT SIGNATURE REDUCTION

H-25. All tactical helicopters are painted with nonreflective IR absorbing paint. All TACAIR may not have IR suppression systems. OH-58A/C and UH-1 aircraft are equipped with the early version of exhaust suppression that reduces IR signature by diverting hot exhaust gases into the rotor system. The OH-58D (Kiowa Warrior) and AH-1 aircraft are all equipped with an exhaust gas suppression system. This system directs exhaust gasses up and away from the horizontal view of the aircraft, IR missile lock-on ranges are reduced. Reducing the aircraft exhaust gas signature aids the effectiveness of the AN/ALQ-144A IR missile jammer on the OH-58D and AH-1. AH-64 aircraft have exhaust suppression called “Black Hole” that reduces the IR signature and aids in the effectiveness of the AN/ALQ-144A IR jammer on the aircraft. UH-60 and EH-60 aircraft are equipped with HIRSS that reduces the IR signature by suppressing hot exhaust gases. HIRSS aids in the effectiveness of the AN/ALQ-144A IR missile jammer. The radar and IR signatures of tactical helicopters are least when viewed from the front. The maximum IR signature is from the rear quadrants, where as the maximum radar signature is from the side aspects.

SITUATIONAL AWARENESS

H-26. All tactical helicopters are equipped with PW RSDS (such as the AN/APR-39[V]1 and the AN/APR-39A[V]1) that alerts the aircrew of radar activity. AH-1, OH-58D and AH-64 aircraft have additional awareness provided by the AN/AVR-2/2A that alerts the aircrews of laser activity. Aircrews use the cues from the RSDS to change modes of flight (contour or NOE) or increase vigilance (actively seek masking terrain features).

ACTIVE COUNTERMEASURES

H-27. ASE countermeasures are required when masking terrain is not available to buy time until the aircraft can maneuver to masking terrain or outside of threat range. IR threats can be jammed by AN/ALQ-144(V)1. Radar threats can be decoyed by the M-130 with chaff (AH-1 and AH-64 aircraft only).

AIRCRFAFT SURVIVABILITY EQUIPMENT SUITES

H-28. Each aircraft is equipped with a suite of ASE designed to protect each aircraft while performing their unique missions.

OH-58D AIRCRAFT SURVIVABILITY EQUIPMENT SUITE CAPABILITIES

H-29. The OH-58D ASE suite (Figure H-1) provides PW radar signal detection for radar directed threats and laser signal detection for laser, laser aided, and DEW threats. Additionally the ASE suite provides omnidirectional IR jamming for IR directed threats. The aircraft signature reduction capabilities include both nonreflective IR absorbing paint and suppressors for hot exhaust gasses.

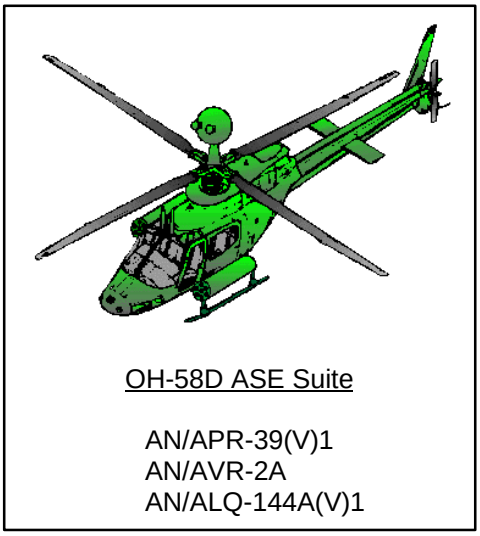

Figure H-1. OH-58D (Kiowa Warrior) ASE Suite

AH-64 AIRCRAFT SURVIVABILITY EQUIPMENT SUITE CAPABILITIES

H-30. The AH-64 ASE suite (Figure H-2) provides PW radar signal detection, PW radar jamming, and decoying for radar directed threats, and laser signal detection for laser, laser aided, and DEW threats. Additionally the ASE suite provides omnidirectional IR jamming and decoying for IR directed threats. The aircraft signature reduction capabilities include both nonreflective IR absorbing paint and “Black Hole” suppressors.

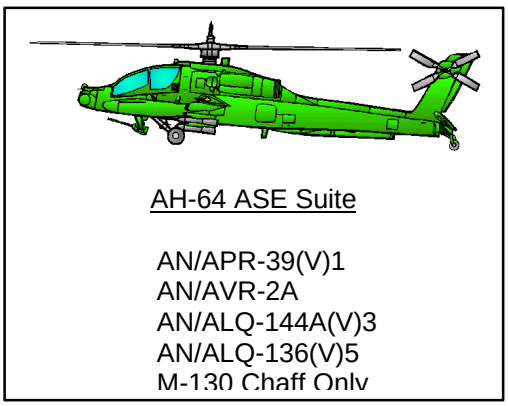

Figure H-2. AH-64 ASE Suite

EH-60 AIRCRAFT SURVIVABILITY EQUIPMENT SUITE CAPABILITIES

H-31. The EH-60 ASE suite (Figure H-3) provides PW radar and CW radar signal detection, CW radar jamming, and decoying for radar directed threats. Additionally the ASE suite provides omnidirectional IR jamming and decoying for IR directed threats. The aircraft signature reduction capabilities include both nonreflective IR absorbing paint and HIRSS suppresses hot exhaust gasses.

UH-60 AIRCRAFT SURVIVABILITY EQUIPMENT SUITE CAPABILITIES

H-32. The UH-60 ASE suite (Figure H-3) provides PW radar and decoying for radar directed threats. Additionally the ASE suite provides omni-directional IR jamming for IR directed threats. The aircraft signature reduction capabilities include both nonreflective IR absorbing paint and HIRSS suppresses hot exhaust gasses.

EH-60 ASE Suite	UH-60 ASE Suite
AN/APR-39(V)2	AN/APR-39(V)1
AN/ALQ-144A(V)1	AN/ALQ-144A(V)1
AN/ALQ-162(V)2	M-130 Chaff Only
AN/ALQ-156(V)2	
M-130 Flare	
M-130 Chaff	

Figure H-3. EH-60 and UH-60 ASE Suites

OH-58A/C AIRCRAFT SURVIVABILITY EQUIPMENT SUITE CAPABILITIES

H-33. The OH-58A/C ASE suite (Figure H-4) provides PW radar signal detection. The aircraft signature reduction capabilities include nonreflective IR paint and exhaust suppression on some aircraft.

OH-58A/C ASE Suite

AN/APR(V)1

Figure H-4. OH-58A/C ASE Suite

UH-1 AIRCRAFT SURVIVABILITY EQUIPMENT SUITE CAPABILITIES

H-34. The UH-1 ASE suite (Figure H-5) provides PW radar signal detection. The aircraft signature reduction capabilities include nonreflective IR paint and exhaust suppression.

UH-1 ASE Suite

AN/APR(V)1

Figure H-5. UH-1 ASE Suite

AH-1 AIRCRAFT SURVIVABILITY EQUIPMENT SUITE CAPABILITIES

H-35. The AH-1 ASE suite (Figure H-6) provides PW radar signal detection, jamming, and decoying for radar directed threats. The ASE suite provides laser signal detection for laser directed threats. The ASE suite also provides omnidirectional IR jamming for IR directed threats. The aircraft signature reduction capabilities include nonreflective paint and hot exhaust suppression.

AH-1 ASE Suite

AN/APR-39(V)1 or AN/APR(V)1
AN/APR-136(V)1/5
AN/ALQ-144A(V)1/3
M-130 Dispenser (CHAFF)

Figure H-6. AH-1 ASE Suite

AIRCRAFT SURVIVABILITY EQUIPMENT SYSTEM DESCRIPTIONS

H-36. A brief description of each ASE system is provided. Configuration requirements that are available to optimize the ASE system are also provided.

AN/APR-39(V)1

H-37. The AN/APR(V)1 is a passive omnidirectional radar warning receiver. The system provides warning of radar threat to allow appropriate evasive maneuvers. The system is capable of detecting all PW radars in the high (E, F, G, H, I, and J) bands as well as missile guidance radars in the low (C and D) bands. The AN/APR-39(V)1 using audio and visual (strobe) to indicate detection of radar systems. The EID software cannot be reprogrammed in the field.

AN/APR-39A(V)1

H-38. The AN/APR-39A(V)1 RSDS is an upgraded version of the AN/APR-39(V)1 that uses a digital processor, alphanumeric symbology display, and synthetic voice warning to provide the aircrew of radar directed AD threat systems. It provides coverage for C/D and E through M band PW radar. The theater specific EID software is reprogrammable.

AN/APR-39(V)2

H-39. The AN/APR-39(V)2 RSDS is a special version of RSDS that uses a digital processor and alphanumeric display to provide detection of PW radar for SEMA. It provides coverage for C/D and E through J band PW radar. The system has the capability of detecting all PW radar's normally associated with hostile SAM, airborne intercept, or antiaircraft weapons. The EID software is reprogrammable and specific theater selected before flight.

AN/AVR-2/2A

H-40. The AN/AVR-2/2A laser detecting set is a passive laser warning system provides input to the AN/APR-39A(V)1 to detect LASER energy. The 2A version is also used as sensors for the MILES AGES. The system has a reprogrammable EID.

AN/ALQ-144A(V)1/3

H-41. The AN/ALQ-144A(V)1/3 CMS (Figure H-7) is an active, continuous operating omnidirectional, IR jammer systems for helicopters designed to confuse or decoy threat IR missile systems. The AN/ALQ-144A(V)1/3 CMS is designed to provide jamming of all known threat IR missile systems when operated on an aircraft that has been equipped with low reflective paint and

engine exhaust suppressers. The system has specific JPN settings that must be set prior to flight.

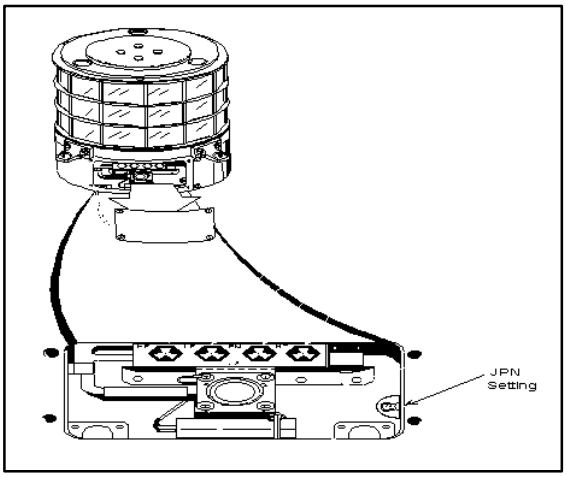

Figure H-7. AN/ALQ-144A Setting

AN/ALQ-136(V)5

H-42. The AN/ALQ-136(V)5 CMS is an active, PW radar jammer designed to confuse or decoy threat PW radar systems. The system jams specific threat systems and operators must know the capabilities and limitations of the AN/ALQ-136(V)5. The system has a training/war switch that must be set prior to flight.

M-130

H-43. The M-130 general purpose dispenser dispenses chaff and flares. The system is operated either manually or automatically through interface with other countermeasure systems. The chaff provides protection against radar directed antiaircraft weapon systems, while the flares provide protection against IR directed missile systems. When dispensing chaff, the M-130 reduces or eliminates the enemy's ability to hit and destroy aircraft by use of radar-controlled, antiaircraft weapons. When dispensing flares, the M-130 reduces or eliminates the enemy's ability to hit and destroy aircraft by use of IR guided missiles. When the M-130 is set to dispense chaff, the electronic control module must be set with the program setting for the aircraft prior to flight.

AN/ALQ-162(V)2

H-44. The AN/ALQ-162(V)2 CMS provides warning and protection against SAMs and airborne intercept missiles that use CW illuminator radar for guidance. The CW signals detected by the system will be validated and jamming will be initiated in conjunction with threat identification given to the aircrew. The specific action taken by the system is determined by warning and jamming thresholds programmed into the system. The system has specific jam settings that must be set prior to flight.

AN/ALQ-156(V)2

H-45. The AN/ALQ-156(V)2 CMS is an airborne radar system that provides protection to the aircraft in which it is installed by detecting the approach of antiaircraft missiles. Upon detection, the missile detector automatically initiates a signal that triggers the M-130 general dispenser system. The dispenser system releases a flare to decoy an IR seeking missile away from the aircraft.

AIRCRAFT SURVIVABILITY EQUIPMENT CONFIGURATION SETTINGS

H-46. Configuration settings for ASE are located on the classified MSEC-BBS sponsored by the ARAT located at Eglin Air Force Base, Florida. Connection to the MSEC-BBS requires an accredited computer, communications software, null modem cable, and a STU-III. The MSEC-BBS must be contacted to ensure each unit has the most current ASE settings for each theater of operations. MSEC-BBS can be reached at DSN 872-2166 or commercial (904) 882-2166 for instructions to gain access.

TACTICAL OPERATIONS OFFICERS AND AIRCRAFT SURVIVABILITY EQUIPMENT AND/OR ELECTRONIC WARFARE OFFICERS

H-47. For ASE to provide effective protection during a mission, configuration settings must be optimized for the threats encountered. The tactical operations officer at the brigade and battalion staff assist the S3 in mission planning for aircraft survivability while accomplishing the mission. TO&E place the tactical operations officer in the aviation troop as a CW3, in the squadron operations as a CW4, and in the regiment and/or brigade as a CW5. The tactical operations officer is identified by the SQI I (e.g., 152DI). The ASE and/or EW officer is a CW2 in the aviation troop. ASE and/or EW officer is identified by the ASI H3 (e.g., 152D0H3). ASE and/or EW officer ensures optimum ASE configuration settings are prepared for each flight. AR 611-112 describes the tactical operations officer position as warrant officers that are qualified to—

- Plan, schedule, coordinate, and brief tactical and nontactical missions.
- Operate the aviation mission planning system.
- Develop, plan, coordinate and brief EW operations.
- Manage flying hour programs and ALSE programs.

SECTION III—OPERATIONAL EMPLOYMENT CONSIDERATIONS

GENERAL

H-48. Aircraft survivability functions must be included throughout mission planning, rehearsal, execution, and recovery operations. Intelligence drives the operations and mission planning begins with the receipt of the situation and mission and continues through completion of mission execution and AAR. From the receipt of enemy situation and mission, it is important to plan and implement aircraft survivability functions.

MISSION PLANNING

H-49. ASE and EW must be considered in all phases of mission planning. The level of planning involved is always predicated on the time, information, and personnel available. OPLANs and OPORDs for military operations are extensive in scope and contain information that act as a baseline for most unit operations.

OPERATIONS ORDER AND/OR OPERATIONS PLAN

H-50. The generation of the OPORD begins upon receipt of the enemy and friendly situation, the mission, and the commander's intent. The EW Annex (Figure H-8) is created to support the OPORD or OPLAN using this information. The enemy and friendly situations are further defined with the emphasis on the EW capabilities each have to find, fix, jam, deceive, disrupt, or destroy each other. Once the situation is clearly defined, the mission is analyzed to evaluate the risk to friendly forces while accomplishing the mission within the prescribed guidelines. After the risk assessment is complete, risk reduction techniques are specified in the execution instructions. These techniques require the commander's approval if the mission constraints need to be altered significantly from the original intent. The next step is to determine service support for EW and command and signal guidance necessary to accomplish the EW phase of the mission.

FRAGMENTARY ORDER

H-51. Once the OPORD (Figure H-9) (and EW Annex) is generated, it becomes the base document. For specific missions, complete OPORDs may not always be required. In these instances, FRAGOs outlining the changes from the basic OPORD are created and issued to affected units. Upon receipt of the FRAGO, the staff planners must evaluate the information available and revalidate the EW Annex. Any changes to the EW Annex must be detailed and disseminated to the aircrews as part of the mission briefing.

SECURITY CLASSIFICATION

ISSUING HEADQUARTERS
LOCATION
DAY, MONTH, YEAR, HOUR, ZONE

ANNEX I (ELECTRONIC WARFARE) TO OPORD XXXX-XX (U)

( ) References: List basic documents required.

1. ( ) Situation

a. ( ) Enemy. Refer to annex B. Provide an estimate of the enemy's communications, non-communications, and EW systems capabilities, limitations, and vulnerabilities including the ability to interfere with the accomplishment of the EW mission stated herein. Determine the ability to detect radar altimeter, Doppler, FM, VHF, and UHF communications, and the ability to interrogate transponder for modes 1, 2, 3A, and 3C. Determine AD EW systems and analyze parameters (i.e., frequencies, PRF, PRI, scan type, wavelength) for use in risk analysis.

b. ( ) Friendly. Provide a list of friendly EW systems available for the mission (i.e., communications, noncommunications, navigation, sensors, countermeasures, Electro-optical systems). Include friendly EW assets that can exploit and disrupt the enemy's usage of the electromagnetic spectrum.

c. ( ) Assumptions. State any assumptions about friendly or enemy EW capabilities and possible COAs that may influence the planning or execution of EW operations.

2. ( ) Mission. State the mission to be accomplished by EW operations to support the mission in the basic plan.

3. ( ) Execution

a. ( ) Concept of operations. Summarize the scope of EW operations and the methods and resources to be used. Include TTP's for the threats that may be encountered.

b. ( ) Tasks. In separate subparagraphs, assign individual tasks to EWOs and crews including instructions and references.

c. ( ) Coordinating Instructions. Place instructions applicable to two or more sub-units in the final sub-paragraph.

1. ( ) Guiding Principles. State or refer to policies, doctrine, tactics, techniques, and procedures that provide guidance to be followed. Establish any additional guidance and authorized deviations from standardized practices. Describe any constraints that may apply to the mission.

This sample EW appendix is unclassified, but when actually accomplished should show proper classification markings of each paragraph.)

Figure H-8 Sample Format for an Electronic Warfare Annex to Operations Order

2. ( ) Special Measures. Provide any special procedure to be used that is not provided elsewhere.

4. ( ) Service Support. Specify support units to provide EW service support. Include verification of threat parameters and ASE settings through the ARAT.

5. ( ) Command and Signal. Provide information on IFF mode settings and mode activation/ deactivation line, ASE configuration settings, Have Quick settings, SINCGARS settings, A^2C^2 frequencies, AWACS contact points, and brevity codes.

Acknowledge:

Name (Commander's last name)
Rank (Commander's rank)

OFFICIAL:
APPENDICES:
DISTRIBUTION:

(SECURITY CLASSIFICATION)

(This sample EW appendix is unclassified, but when actually accomplished should show proper classification markings of each paragraph.)

Figure H-8. Sample Format for an Electronic Warfare Annex to Operations Order (continued)

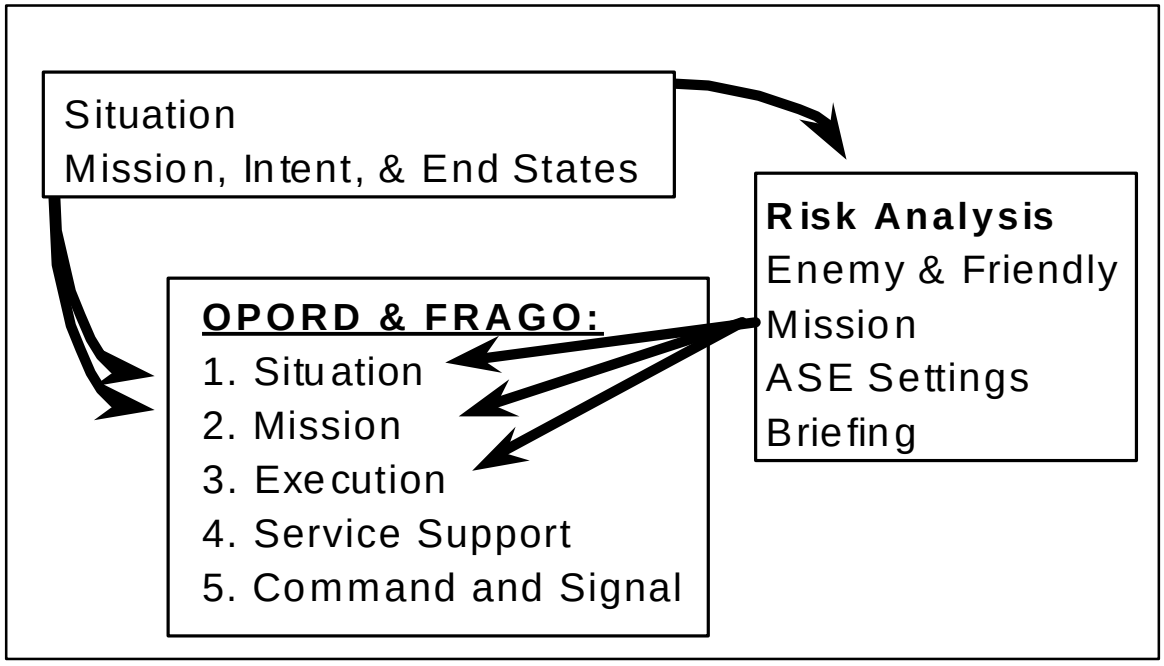

Figure H-9. Operations Order and Fragmentary Order

AIRCRAFT SURVIVABILITY EQUIPMENT CONSIDERATIONS IN RISK ASSESSMENT

IDENTIFY THE RISK

H-52. To perform a thorough risk assessment, detailed information about threat system operating procedures, tactics, system capabilities, and locations must be analyzed to determine the enemy's advantages or disadvantages in the use of EW. The capabilities and limitations of friendly EW systems must be compared to the threats to assess the level of risk associated with the mission. The S2 and the tactical operations officer will identify the following:

- Operating frequencies of radar threats.
- RF threats that can or cannot be detected.
- RF threats radar jamming equipment will affect.
- RF threats that can be decoyed.
- IR threats that may be encountered.
- IR threats that can be detected.
- IR threats that can be jammed or decoyed.
- LASER and/or DEW threats that can or cannot be detected.
- Optical and/or electro-optical threats.

ASSESS THE RISK

H-53. The S2 and tactical operations officer will prioritize the threat systems and optimize ASE settings for the highest priority threats. The level of risk based on the threat's capabilities and limitations, the capabilities and limitations of the ASE, and the mission will be determined (Figure H-10). The highest risk to determine the overall risk to the mission will be used. If the risk due to IR threats is high risk, then the overall mission risk would continue to be high risk. The risk assessment worksheet is used to determine what is causing the highest risks so that controls can be developed to reduce those risks.

MAKE DECISIONS AND DEVELOP CONTROLS

H-54. The S2 and tactical operations officer will determine the optimum ASE configuration settings for each aircraft type and the threats in the mission area.

H-55. Threats that are highly lethal and not countered by ASE are identified, and PIR can be developed and submitted by the S2 to HHQ (for example: The SA-X is very lethal and no organic countermeasures are present. This threat poses a high risk to mission accomplishment. Where is the SA-X located in our AO? The latest time of value for this information is XXXX hours.)

Survivability Risk Analysis

ACFT Type: _____ **Mission:** _____ **Date:** _____

Mission Profile:

	<100' AGL	>100' AGL
Night	Low	Medium
Day	Medium	High

Value: _____

IR Threats:

	Suppressed	Unsuppressed
IRCM	Low	Medium
Non-IRCM	Medium	High

Value: _____

RF Threat:

	Warning	No-Warning
RFCM	Low	Medium
Non-RFCM	Medium	High

Value: _____

E/O Threat:

	Low Visibility & Contrast	High Visibility & Contrast
Masking	Low	Medium
No-Masking	Medium	High

Value: _____

Laser/DEW Threat:

	Warning	No-Warning
Masking	Low	Medium
No-Masking	Medium	High

Value: _____

Highest Value: _____

Overall Risk:

Reevaluate mission profile, ASE, or flight routes.	Low
Reevaluate mission profile, ASE, or flight routes.	Medium
	High

Priority Threats:

IR:	A	B	C	D
RF:	A	B	C	D
E/O:	A	B	C	D
Laser/DEW:	A	B	C	D

ASE Configuration Settings:

ALQ-144A Suppresed: _____ Unsuppressed: _____
ALQ-162 Jam Program: _____
APR-39A(V)1 OFP: _____ EID: _____
APR-39(V)2 Low/High: _____ Theater Position: _____
M-130 Chaff Progam: AH-64: __ UH-60: ___ EH-60: _____
ALQ-156: _____
IFF: Mode1 _____ Mode2 _____ Mode3A _____ Mode3C _____ Mode 4 _____

R= Infrared
IRCM= IR Countermeasures
Suppressed= IR paint & Exhaust
RF= Radio Frequency
RFCM= RF Countermeasures
E/O= Electro-Optical

Figure H-10. Risk Assessment Worksheet

H-56. Risk reduction techniques will be applied to minimize the risk and enhance the probability of survival. Risk reduction measures include the following:

- Plan mission time earlier or later to take advantage of night operations.
- Use only suppressed aircraft for the higher risk portions of the mission.
- Request escort aircraft to suppress threats.
- Plan SEAD at critical points to reduce vulnerability.
- Prep the LZ/PZ with indirect fires.
- Alter flight routes to avoid known AD areas.
- Develop deception plan to include false insertion.
- Reduce electronic signature (EMCON).
- Reduce formation and/or sortie size.

H-57. The ASE and/or EW mission briefing disseminates information and instructions to the aircrews prior to the mission (Figure H-11). The briefing will alert aircrews to the risks associated with the threats, the optimum ASE settings, and a review of the tactics specific to the mission. These tactics include evasive maneuvers, actions on contact, multiship breakup and reformation procedures, and ROE for countermeasures weapons employment. A sample ASE and/or EW mission briefing is contained herein to assist ASE and/or EWOs in completing this task.

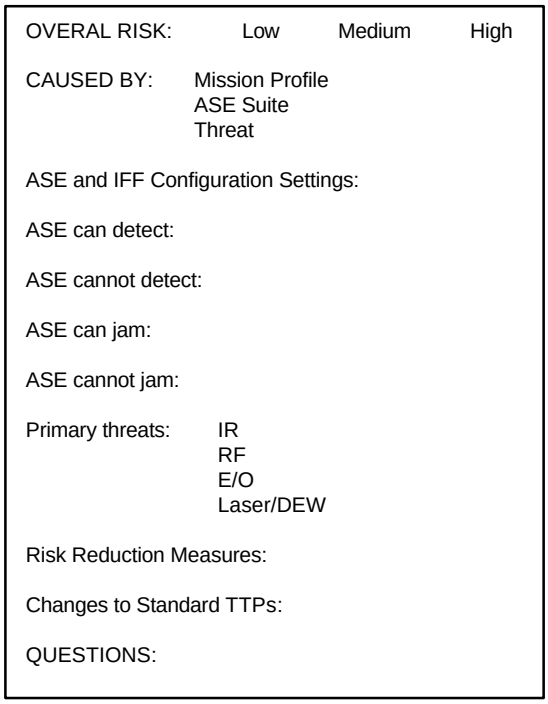

Figure H-11. Sample Format for an Aircraft Survivability

Equipment Mission Brief

IMPLEMENT CONTROLS AND SUPERVISE

H-58. Commanders and aircrews must take an active role in reducing risks by implementing the following controls and supervising their implementation:

- Commanders ensure that ASE and/or EW considerations and configuration settings are considered and briefed to all aircrews and maintenance personnel.
- During preflight checks, aircrews ensure that ASE configuration settings are correct.
- During mission, aircrews ensure that IFF codes are activated and deactivated at proper times and locations during flight.
- During AAR, ensure that debriefings are collected from aircrews.
- Aircrews report ASE and/or EW problems to HHQ (ambiguities, false alarms, equipment failures, and short comings.)
- Aircrews collect data and ensure that the data are put into AMPS for the next mission.

SECTION IV—MISSION EXECUTION

SITUATIONAL AWARENESS

H-59. During conduct of the mission, it is important for aircrews to be familiar with the ASE situational awareness displays and the expected threat indications. Some actions must be performed without delay. When the visual indications of a gun or missile is fired at the aircraft, or ASE indications of radar track or launch, the aircrew has but seconds to perform an action to prevent the aircraft from being engaged.

REACTING TO THREAT ENGAGEMENTS

H-60. Three distinct parts of reacting to threat engagements are indication (determine immediate actions), evasive maneuver (when masking terrain is not readily available), and actions on contact (decision to continue or abort mission).

CREW COORDINATION

H-61. Crew coordination must be rehearsed to perform evasive maneuvers. Standardized terminology such as “missile three o’clock, break right” and “breaking right” should be used to avoid confusion. Other times indications do not require evasive maneuvering, such as radar search or acquisition.

MULTISHIP CONSIDERATIONS

H-62. Formations and spacing intervals should be selected that provide all aircraft maneuver space to evade hostile fire. Standardized terminology such as “chalk two breaking right missile” or “chalk three tracers three o’clock breaking left” should be used to alert the flight to your actions. Briefings

should include evasive formation break up procedures and how to reform the formation after breaking the engagement. It is important to communicate your ASE indications to other aircraft in the formation since you may be the only aircraft receiving it due to terrain, narrow radar beam, altitude, or maintenance problems.

CONCLUSION

H-63. Survivability for Army aviation on the modern battlefield and in stability operations and support operations requires extensive coordination with other staffs. Since Army aviation can cover broad spaces at high speeds, coordination for airspace and fire control measures is paramount. The tactical operations officer and ASE and/or EWO are trained to incorporate ASE and/or EW considerations into the mission planning and execution. ASE is only effective if configured properly and used with tactics to counter the threat's capabilities. Army aviation must plan to make maximum use of the electromagnetic spectrum and fully exploit the weaknesses of the threat's EW capabilities.